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RESEARCH NOTE

CENTRAL STATES FOREST EXPERIMENT STATION
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THINNING FAILS TO STIMULATE 50-YEAR-OLD WHITE PINE

Forest plantations subjected to prolonged overcrowding seldom respond to thinning or at best recover their former vigor very slowly. The first results of thinning in a 50-year-old plantation of white pine (Pinus strobus L.) in east-central Iowa conform to this general experience. Regardless of thinning intensities studied, subsequent growth in basal area, diameter, board feet, and cubic feet has not attained the pretreatment average.

Thinning was studied near South Amana, Iowa, on 6 acres of white pine planted by the Amana Society in 1898. When planted, the trees were spaced 7 by 8 feet (780 trees per acre) on a sandy ridge that was judged unsuitable for cultivated crops. Brinkman and Krajicek[1/] have described the history and growth of this plantation up to 1950, at which time this study of thinning was initiated.

Study

Altogether, four treatments were compared, three intensities of thinning and no thinning. Eight 1/5-acre rectangular plots were laid out in the plantation and a 100 percent inventory made in each plot. Two of the eight plots were subjected to each of the four treatments. Stand data obtained included original basal area, amount removed, residual basal area, and residual volume (table 1). In thinning, the poorest and most defective trees were removed first. These included trees with some evidence of decay, physical injury, or deformity.

1/ Brinkman, Kenneth A., and Krajicek, John A. Growth of a white pine plantation in Iowa. U.S. Dept. Agr., Forest Serv., Cent. States Forest Expt. Sta. Note 61, 2 pp., illus. 1950.

Results

The overcrowding that existed for some 20 years before thinning resulted in extremely small live crowns; few were more than 12 feet in length. After thinning, crown growth occurred as small lateral increases, the trees having attained almost the full height (70 to 75 feet) possible on this site. Eleven years after thinning, residual trees had not responded sufficiently to utilize the space made available (fig. 1). Also, there was some loss of crown because of severe ice and windstorms that occurred a few years after thinning. This damage was most severe in openings where exposure was greatest.

The 11-year results indicate that growth differences between thinning intensities are not of practical significance either for basal area or for volume (table 2).

The high volumes and growth rates primarily result from the high stocking. The number of trees ranged from 200 per acre (149 square feet basal area) on the heavily thinned plots to 375 (251 square feet basal area) on the unthinned check plots. By most standards, this is exceptionally high stocking for a stand of this age, even in the heavily thinned plots where 34 percent of the basal area was removed.

Figure 1.--View of crowns showing lack of development and space utilization.

Annual diameter growth during the 11 years following thinning was only about half the average for the 50 years before thinning; for at least 20 years before thinning, the growth rate had steadily declined. Basal area growth shows a definite trend, being best after light thinning and poorest without thinning. But because annual diameter growth was roughly the same regardless of thinning intensity, the number of residual trees was the main influence on the growth in basal area and volume. This is representative of the general results of the study in that some thinning was little better than none.

Table 1.--Original basal area, amount cut, and volume of residual stand per acre

Thinning intensity	Original basal area	Basal area cut	Residual stand		
			Basal area	Volume	
	Square feet	Percent	Square feet	Board feet[1]	Cubic feet[2]
Light	248	18	203	32,905	5,921
Medium	237	27	174	28,190	4,838
Heavy	224	34	149	22,735	4,218
None	251	0	251	35,295	6,711

[1] International 1/4-inch rule, trees 9.6 inches and larger at breast height.

[2] On pole-sized trees (4.6 to 9.5 inches d.b.h.), merchantable height was taken to approximately a 3-inch top. For sawlog-sized trees, the upper point of merchantability varied to comply with the utilization standards in Mesavage's cubic foot volume tables (Mesavage, Clement. Tables for estimating cubic-foot volume of timber. U.S. Dept. Agr., Forest Serv., South. Forest Expt. Sta. Occas. Paper 111. 1947). The minimum diameter at the upper point of merchantability was 6 inches.

Table 2.--Average annual growth

Thinning intensity	D.b.h. per tree	Basal area per acre	Volume	
	Inches	Square feet	Board feet[1]	Cubic feet[2]
Light	0.096	3.77	1,027	125.5
Medium	.096	3.18	910	128.0
Heavy	.100	2.91	993	120.0
None	.071	1.90	918	105.2

[1] International 1/4-inch rule, trees 9.6 inches and larger at breast height.

[2] Footnote 2, table 1.

Conclusions

None of the thinning intensities used restored the plantation to its former vigor and productivity. Probably, the main reasons are that prolonged overcrowding reduced crown size, crowns failed to increase in length and width in response to thinning, and the high stocking resulted in extreme competition for moisture and nutrients in the sandy soil. Thus, the total production of usable wood could probably have been much greater had thinning been done at the peak of early growth.

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